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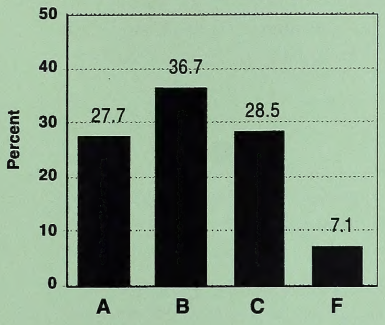
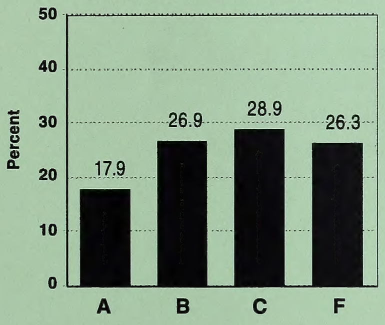
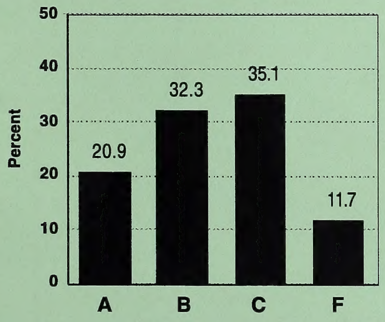
Biology 30

Diploma Examination Results
Examiners' Report for June 1996


School-Awarded Mark


Diploma Examination Mark


Final Course Mark

The summary information in this report provides teachers, school administrators, students, and the general public with an overview of results from the June 1996 administration of the Biology 30 Diploma Examination. This information is most helpful when used with the detailed school and jurisdiction reports that have been mailed to schools and school jurisdiction offices. An annual provincial report containing a detailed analysis of the combined January, June, and August results is published each year.

Description of the Examination

The Biology 30 examination consists of 48 multiple-choice questions worth 60%, 8 numerical-response questions worth 10%, and 2 written-response questions worth 30% of the total examination mark.

Achievement of Standards

The information reported is based on the final course marks achieved by 9 585 students in Alberta who wrote the June 1996 examination. This represents an increase of 219 students compared with June 1995, and an increase of 72 students compared with June 1994.

- 88.3% of the 9 585 students achieved the acceptable standard (a final course mark of 50% or higher).
- 20.9% of the 9 585 students achieved the standard of excellence (a final course mark of 80% or higher).

Generally, student achievement in Biology 30 was very good. The percentage of students who achieved the acceptable standard (88.3%) was nearly identical to the percentage for June 1995 (89.9%). Most students demonstrated a very good understanding of population genetics, of how populations interact with their environment, of differentiation and development, and of the nervous and endocrine systems. They demonstrated a good understanding of human reproductive systems and how they are regulated. Some students had difficulty with concepts related to cell division, and Mendelian and molecular genetics. The majority of students were able to describe and evaluate scientific research procedures well, and they demonstrated a very good understanding of science, technology, and society connections.

Approximately 57.4% of the students who took the course were female. Of this female population, approximately 88.9% achieved the acceptable standard on the course, compared with 87.2% of the male population. The standard of excellence was achieved by approximately 20% of this female population, compared with 22% of the male population.

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Student Evaluation

Alberta
EDUCATION

Provincial Averages

- The average school-awarded mark was 69.3%.
- The average diploma examination mark was 61.8%.
- The average final course mark, representing an equal weighting of the school-awarded mark and the diploma examination mark, was 65.9%.

Approximately 7.2% of the students who wrote the examination in June 1996 and received a school-awarded mark had written at least one other Biology 30 Diploma Examination during the January 1995 to January 1996 period. This subpopulation (690) achieved an examination average of 53.6%, compared with 62.4% for the population (8 895) who first wrote a Biology 30 examination in June 1996. However, the group of students who rewrote (690) increased their examination average score from 47.9% to 53.6%.

Results and Examiners' Comments

This examination has a balance of question types and difficulties. It is designed so that students who achieve the acceptable standard will obtain a mark of 50% or higher and students achieving the standard of excellence will obtain a mark of 80% or higher.

In the following table, diploma examination questions are classified by question type: multiple choice (MC), numerical response (NR), and written response (WR). The column labelled "Key" indicates the correct response for multiple-choice and numerical-response questions. For numerical-response questions, a limited range of answers was accepted as being equivalent to the correct answer. For multiple-choice and numerical-response questions, the "Difficulty" indicates the proportion (out of 1) of students answering the question correctly. For written-response questions, the "Difficulty" is the mean score achieved by students who wrote the examination.

Questions are also classified by general learner expectations.

Knowledge:

GLE 1	Nervous & Endocrine Systems
GLE 2	Reproductive Systems & Hormones
GLE 3	Differentiation & Development
GLE 4	Cell Division & Mendelian Genetics
GLE 5	Molecular Genetics
GLE 6	Population Genetics & Interaction

Skills:

SPSC	Scientific Process Skills and Communication Skills

Science, Technology, Society:

STS	Connections Among Science, Technology, & Society

Blueprint

Question	Key	Difficulty	GLE 1	GLE 2	GLE 3	GLE 4	GLE 5	GLE 6	SPSC	STS
MC1	D	0.777	√							√
MC2	B	0.584	√							√
MC3	B	0.672	√						√	
MC4	B	0.547	√							√
MC5	A	0.678	√							√
MC6	C	0.705	√							
MC7	D	0.682	√							
MC8	C	0.642	√							
MC9	D	0.835	√							√
MC10	D	0.801	√							√
MC11	A	0.690	√							√
NR1	8123	0.682		√						
MC12	C	0.670		√						√
MC13	C	0.435		√						√
MC14	B	0.452		√					√	
MC15	B	0.613		√					√	
MC16	D	0.757		√						√
MC17	D	0.837		√					√	
MC18	A	0.753		√						√

Question	Key	Difficulty	GLE 1	GLE 2	GLE 3	GLE 4	GLE 5	GLE 6	SPSC	STS
MC19	C	0.700			√					√
MC20	A	0.721			√					
MC21	D	0.760			√				√	
MC22	A	0.788			√					√
MC23	A	0.528			√					
MC24	A	0.627				√			√	
MC25	A	0.444				√			√	
MC26	B	0.642				√			√	
MC27	C	0.573				√			√	
NR2	50	0.696				√			√	
MC28	C	0.509				√			√	
MC29	C	0.680				√			√	
MC30	B	0.646						√	√	
MC31	C	0.433				√			√	
NR3	0.25	0.460				√			√	
MC32	C	0.782				√			√	
MC33	B	0.594				√			√	
MC34	D	0.791				√			√	
MC35	C	0.587				√			√	
MC36	C	0.646				√			√	
NR4	3311	0.798				√			√	
NR5	0.50	0.755				√			√	
NR6	75	0.422				√			√	
MC37	B	0.418					√			√
MC38	D	0.696					√			
MC39	C	0.511					√			
MC40	D	0.685					√			
MC41	D	0.760					√		√	
NR7	5	0.734					√		√	
MC42	B	0.572						√	√	√
MC43	D	0.802						√	√	√
NR8	123	0.811						√	√	
MC44	D	0.791						√		
MC45	D	0.613						√		
MC46	A	0.752						√		
MC47	C	0.668						√	√	
MC48	B	0.690						√		√
WR1	–	0.542	√				√	√	√	√
WR2	–	0.467	√			√	√			√

Subtest: Multiple Choice and Numerical Response

When analyzing detailed results, please bear in mind that subtest results **cannot** be directly compared. Results are in average raw scores.

- Multiple choice and numerical response: 36.9 out of 56
- General Learner Expectations

GLE 1	Nervous & Endocrine Systems	7.6	out of	11
GLE 2	Reproductive Systems & Hormones	5.2	out of	8
GLE 3	Differentiation & Development	3.5	out of	5
GLE 4	Cell Division & Mendelian Genetics	10.4	out of	17
GLE 5	Molecular Genetics	3.8	out of	6
GLE 6	Population Genetics & Interaction	6.3	out of	9
Skills		18.8	out of	29
STS		11.5	out of	17

- Multiple choice: 31.5 out of 48
- Numerical response: 5.4 out of 8

Subtest: Written Response

Results are in average raw scores.

- Written Response: 12.4 out of 24
- Question 1: 6.5 out of 12
- Question 2: 5.6 out of 12

Alzheimer's disease is associated with the deterioration of memory and mental capacity due to decreased production of acetylcholine and loss of up to three-quarters of the neurons in parts of the brain.

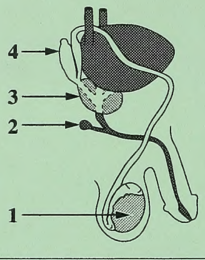
2. Which phase of impulse transmission would be lacking in a person with Alzheimer's disease?

   A. Restoration of polarity in neurons
   •B. Excitation of postsynaptic neurons
   C. Maintenance of resting potentials in neurons
   D. Active transport of sodium and potassium in neurons

Prostate Cancer

Treatment for prostate cancer may include radiation, drug therapy, or surgical removal of the gland. Cancerous growth of the prostate is stimulated by testosterone and inhibited by estrogen. Early detection and treatment often prevent the spread of this type of cancer.

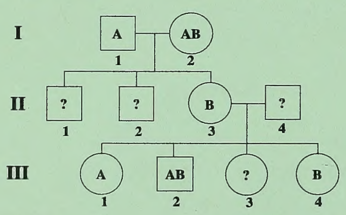
The Male Reproductive System



13. A symptom of an enlarged prostate gland may be

   A. enlarged testes
   B. abdominal pain
   •C. reduced urine flow
   D. decreased sperm production

A Pedigree Showing the Blood Types of a Family



33. Which row correctly shows the probability of individuals **II 2** and **III 3** having type O blood?

Row	Probability of individual II 2 having type O blood	Probability of individual III 3 having type O blood
A	0.00	0.00
•B	0.00	0.25
C	0.25	0.00
D	0.25	0.25

Multiple-Choice and Numerical-Response Questions

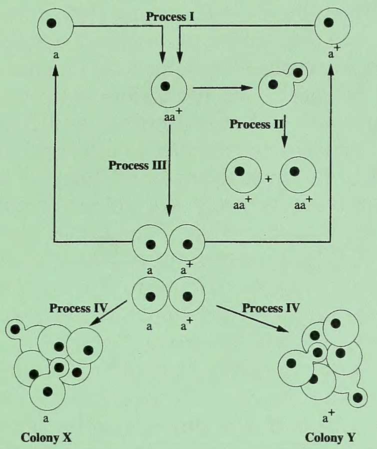
Multiple-choice question 2 required the students to select the response that demonstrated their understanding of nerve impulse transmission from neuron to neuron. Most students achieving the standard of excellence (93.8%) correctly selected alternative B for question 2, thereby demonstrating that they understood that postsynaptic neurons are stimulated by the presence of acetylcholine. However, only 58.4% of all students who wrote the exam were able to correctly answer this question.

Multiple-choice question 13 required the students to identify the physiological effects of an enlarged prostate gland. When faced with choosing between a plausible distracter and the answer, overall the students had difficulty. Only 43.5% chose the correct answer, while 39.9% chose alternative B. However, 59.5% of the students achieving the standard of excellence demonstrated that they understood that a symptom of an enlarged prostate gland would be reduced urine flow and not abdominal pain.

Multiple-choice question 33 required the students to determine the probability of selected individuals having a particular phenotype. Only 59.4% of the students determined the probability for the phenotype of each individual correctly; whereas, in question 32, 78.2% of the students were able to determine the correct genotype from a known phenotype and from predicted phenotypes. It appears that the concept of probability is difficult for students.

The Life Cycle of Baker's Yeast

The life cycle of baker's yeast demonstrates a number of biological processes. Gene a and its allele a^+ are present in this yeast population. Genotypes of cells are shown below each cell or group of cells.

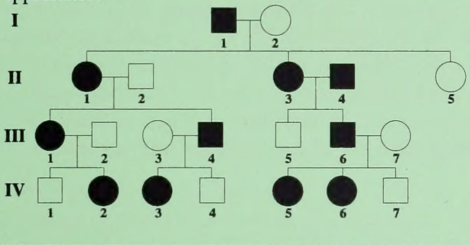


25. Processes **II** and **IV** illustrate budding. The information in the diagram indicates that budding is a type of

- •**A.** asexual reproduction that produces haploid or diploid cells
- **B.** asexual reproduction that produces diploid cells
- **C.** sexual reproduction that produces haploid or diploid cells
- **D.** sexual reproduction that produces haploid cells

A Pedigree Showing the Incidence of Opalescent Dentin in a Family

This pedigree shows the incidence of opalescent dentin in a family. People with this trait have insufficient enamel on their teeth. The dentin inside the teeth shows through, giving the teeth a mottled, pearl-like appearance.



Numerical Response

3. If individual **III 1** and individual **III 2** had another child, what is the probability that this child would be a **female** with **opalescent dentin**?

(Record your **answer as a value from 0 to 1**, rounded to two decimal places, in the numerical-response section of the answer sheet.)

Answer: 0.25

Multiple-choice question 25 required the students to analyze the life cycle of baker's yeast and to determine the type and product of reproduction illustrated by processes II and IV. Overall, only 44.4% of the students demonstrated the understanding that asexual reproduction produces haploid and diploid cells. Overall, 41.5% selected alternative B indicating that they did not use the information provided or that they did not understand that the symbols a^+ and a represented haploid cells. Of the students achieving the standard of excellence, 66.4% chose the correct answer.

Numerical-response question 3 required the students to determine what the probability would be for the indicated couple of having a child with opalescent dentin **and** being female. Since these are independent events, the students were required to multiply the probability of having a child with opalescent dentin with the probability of being female. Overall, only 46.0% of the students were able to correctly calculate that value to be 0.25. Approximately 33% of the students determined the value to be 0.50, indicating they had only solved part of the answer to the question. Of the students achieving the standard of excellence, 76.6% were able to combine the probabilities and calculate the answer correctly.

Numerical Response

6. Snapdragons may be tall or short, and they may be red, white, or pink. The allele for short is recessive and the alleles for colour display incomplete dominance. A plant, heterozygous for both traits, was self-pollinated and produced 200 offspring. How many of these 200 offspring would be expected to be both tall and pink?

(Record your **answer** in the numerical-response section of the answer sheet.)

Answer: 75 plants

The peppered moth occurs in two "morphs"; that is, it may have one of two distinct forms. One morph is light and mottled (or light-peppered), and the other morph is black. The black morph's colour is controlled by a dominant allele. A British naturalist performed an experiment on moth mortality. He released known numbers of marked black and light-peppered moths in unpolluted woodlands and in polluted, soot-blackened woodlands. He then recaptured a portion of the released moths. The following data were recorded.

	Light-peppered morph	Black morph
Unpolluted woodland		
Marked and released	496	476
Recaptured later	62	30
Percent recaptured	12.5%	6.3%
Soot-blackened woodland		
Marked and released	137	447
Recaptured later	18	?
Percent recaptured	13.1%	27.5%

42. Based on the data, a valid prediction is that within 100 years, the frequency of the dominant allele for body colour in a peppered moth population would likely

A. become zero in soot-blackened woodlands
•B. increase in soot-blackened woodlands
C. become zero in unpolluted woodlands
D. increase in unpolluted woodlands

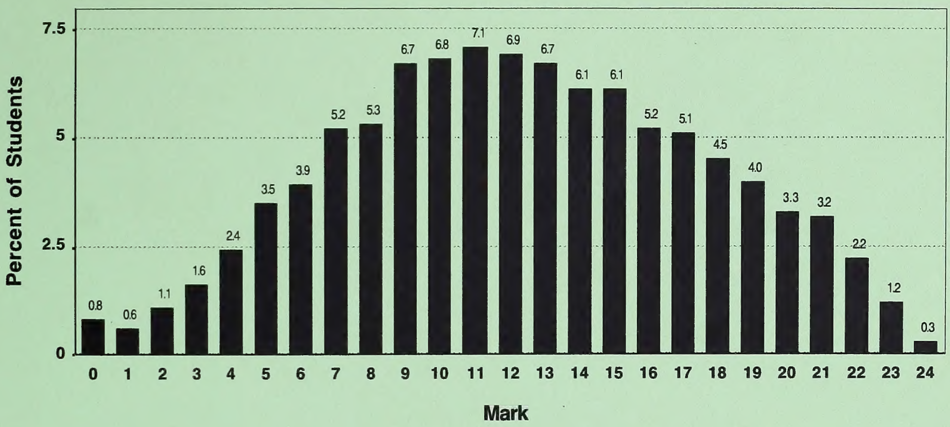
Numerical-response question 6 required the students to calculate the number of offspring expected to be both tall and pink from a cross of two plants heterozygous for both traits. First, the students were to determine what the predicted probability would be for the offspring to be both tall and pink, then the students were to calculate the expected number by comparing the probability to the total number (200) of offspring produced. The probability of the occurrence of offspring with both characteristics is 37.5%; therefore, the expected number would be 75 plants. About 2% of the students indicated that 37.5 would be the answer, illustrating that they did not complete the calculation. The probability of the occurrence of tall offspring is 75%; therefore, the expected number of tall offspring would be 150 plants. Almost 4% of the students indicated that 150 would be the answer, illustrating that they did not consider both characteristics. The probability of the occurrence of pink flowering offspring is 50%; therefore, the expected number of pink flowering offspring would be 100 plants. Almost 10% of the students indicated that 100 would be the answer, also illustrating that they did not consider both characteristics. Although this proved to be a difficult question overall, of the students achieving the standard of excellence, 83.8% correctly calculated the number of plants to be 75.

Multiple-choice question 42 required the students to predict how the frequency of the dominant allele for body colour in a peppered moth population would fluctuate. Only 57.2% selected alternative B, correctly predicting that it would likely increase in soot-blackened woodlands. However, 80.2% of the students correctly interpreted the data presented, as demonstrated by their correct selection of alternative D for question 43. Of the students achieving the standard of excellence, 79.5% answered question 42 correctly; whereas, 97.2% of this same group answered question 43 correctly. It appears that making accurate predictions is more difficult for students than is making accurate interpretations.

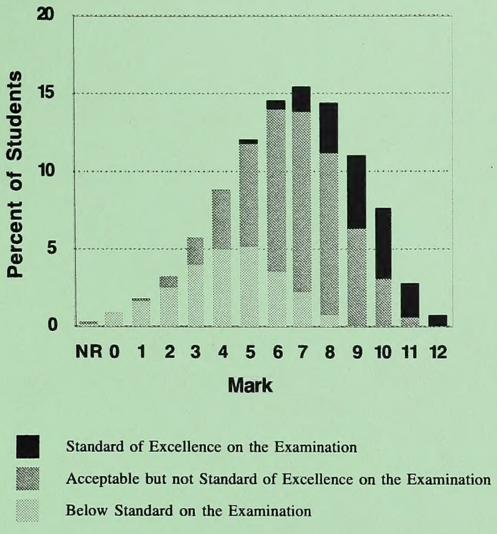
Written-Response Questions

Of the students who wrote the examination, 0.9% received no marks for both written-response questions, 56.4% received 12 marks or more out of 24, and 11.4% received 20 marks or more out of 24.

Distribution of Marks for Written Response



Distribution of Marks for Question 1



Question 1: This process skill question, which related to the study of the effectiveness of a treatment of either malathion or d-phenothrin on lice, was attempted by almost all students (99.7%) who wrote the examination.

Most subparts of the question required students to analyze data and then provide variables, a graph, predictions, explanations, and to identify limitations of this study.

In part a, most students identified the different variables of the experiment; however, some students considered the control group to be a fixed variable.

In part b, most students demonstrated good graphing skills, however their major weakness was determining the proper scale of the x axis.

In part c, students had difficulty with predicting a physiological effect on neural transmission. Their responses tended to be general, giving the effects of insecticides on muscles and the heart, hence mixing physiological effect with biological result.

In part d, most students identified the relationship; however, some students neglected to explain why parasitism was the answer, or they reported that the rabbits do not benefit from the relationship. This is not synonymous with the rabbits being harmed by the relationship.

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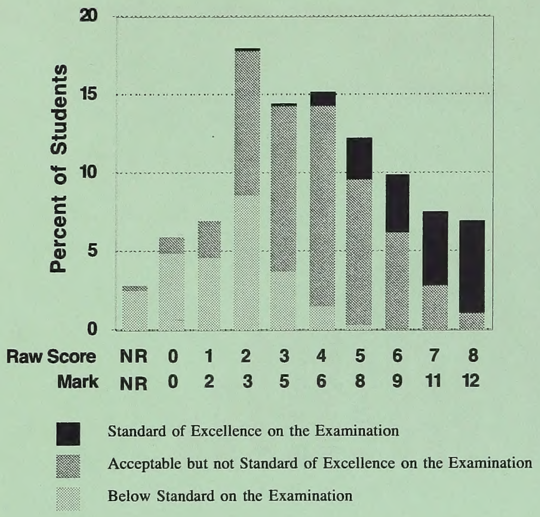
Distribution of Marks for Question 2



In part *e*, many students demonstrated that they do not know how organisms develop resistance. In many cases, they incorrectly linked immunity to resistance.

In part *f*, most students identified two problems with the experiment; however, many students did not continue to explain why they would be problematic.

On this 12 mark question, the average mark was 6.51 or 54.3%. The acceptable standard on this question was achieved by 66.6% of the student population, with 11.4% achieving the standard of excellence. Of the female students who wrote the examination, 66.5% achieved the acceptable standard and 11.6% achieved the standard of excellence. The average mark on this question for the female population was 54.1%. Of the male students who wrote the examination, 67.6% achieved the acceptable standard and 11% achieved the standard of excellence. The average mark on this question for the male population was 54.5%.

Question 2: This extended-response question was attempted by 97.1% of the students who wrote the examination. The question required the students to identify the hormone lacking in a person with type I *diabetes mellitus*, explain two physiological blood glucose regulatory mechanisms, draw a feedback loop, explain why islet cell transplants are effective, and describe technological and societal issues that could have arisen at the time of the development of the islet cell transplant procedure.

The majority of the students identified the hormone to be insulin. Most of the students were able to identify one physiological blood glucose regulatory mechanism, i.e. the conversion of glucose to glycogen; however, a number of the students confused the terms glycogen and glucagon. Generally, the feedback loops were poorly diagrammed, as they rarely included substrates, processes, and structures. Students were able to address the positive effects of islet cell transplants. The students addressed the technological issues aspect of the question very well; however, the societal issues they identified tended not to be from the perspective of the researcher, as was asked. The majority of the students used complete sentences to answer this question, however, the organization of responses was more at the acceptable standard than at the standard of excellence.

This question was marked holistically. Two markers read each response, and each assigned a score from 0 to 4. These scores were added to obtain a raw score from 0 to 8. This raw score was then converted to a mark out of 12. On this 12-mark question, the average mark was 5.6 or 46.7%. The acceptable standard on this question was achieved by 51.9% of the student population, with 14.5% achieving the standard of excellence. Of the female students who wrote the examination, 52.8% achieved the acceptable standard and 14.5% achieved the standard of excellence. The average mark on this question for the female population was 47.5%. Of the male students who wrote the examination, 50.7% achieved the acceptable standard and 14.3% achieved the standard of excellence. The average mark on this question for the male population was 46.4%.

For further information, contact Karen Slevinsky (kslevinsky@edc.gov.ab.ca) or Phill Campbell (pcampbell@edc.gov.ab.ca) at the Student Evaluation Branch at 427-0010. To call toll-free from outside of Edmonton, dial 310-0000.

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